iSAMN 2023
7th International Symposium on Advanced Materials and Nanotechnology

Enhancing Uric Acid Electrochemical Detection with Copper Ion-Activated Mini Protein Mimicking Uricase within ZIF-8

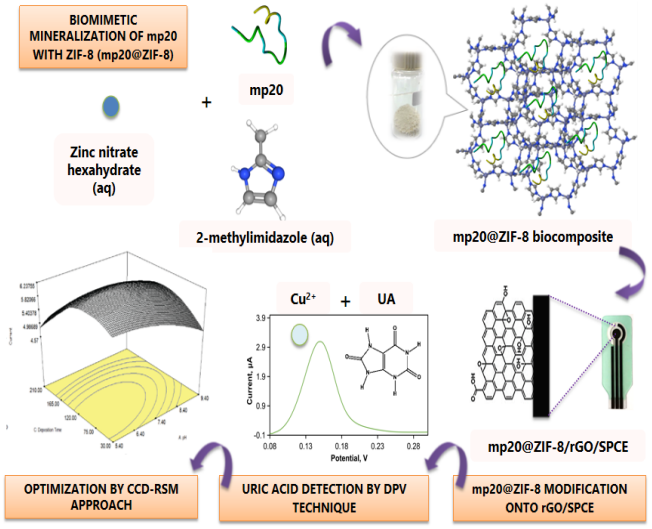
Organised by:
UPM Universiti Putra Malaysia
Institut Nanosains dan Nanoteknologi
Institute of Nanoscience and Nanotechnology

P04

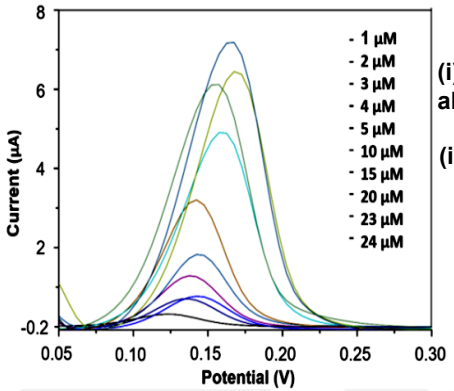
INTRODUCTION

The design of mini proteins mimicking uricase (mp20) based on the conserved active site residues was found not to exhibit uricase activity, thus, affecting the catalytic activity of mp20. The preliminary studies were conducted to explore the potential of inactive of mp20 as a bioreceptor in uric acid electrochemical sensing within zeolitic imidazolate framework-8. This work reports the activated mp20@ZIF-8 will be explored using Cu(II) ion as cofactor for the electrochemical sensing of uric acid.

MATERIALS & METHODS



RESULTS & DISCUSSION



Mechanism

(i) Uric acid + $2Cu^{2+}$ + $2H_2O$ —mp20→ allantoin + $2Cu^{+}$ + CO_2 + $2H^{+}$

(ii) $2Cu^{+}$ ⟶ $2Cu^{2+}$ + $2e^{-}$

Table 1. Data validation of uric acid in physiological samples

	Added (µM)	mp20@ZIF-8/rGO/SPCE (µM)	Recovery (%)	HPLC (µM)	Recovery (%)
Human serum	250	231.9	92.8	225.9	90.4
	300	294.4	98.1	278.5	92.8
	350	332.8	95.1	344.0	98.3
Urine	250	274.8	109.9	269.9	108.0
	300	284.3	94.8	305.9	101.9
	350	324.4	92.7	363.4	103.8

CONCLUSION

- The electrocatalytic oxidation of uric acid was revealed to be feasible in the presence of metal cofactors.
- LOQ = 0.70 µM and LOD = 0.21 µM
- The stability up to 60 days with a signal change below 4.15%.
- The developed of highly sensitive and selective biosensor as an attractive platform in the field of clinical diagnosis.

Table 2. Changes of current density upon uric acid detection with the presence of several interferents

Interferents	Signal Change (%)	RSD (%)
Ascorbic acid	0.93	0.22
Urea	2.21	0.62
Glucose	0.66	0.30
L-cysteine	2.61	0.44
Creatinine	0.37	0.12
Stability		
14	1.37	0.74
30	3.65	0.71
60	4.15	0.45

Researcher's name: Associate Prof. Dr. Shahrul Ainliah Alang Ahmad

Co- Researchers' name: Siti Fatimah Nur Abdul Aziz, Ong Sin Hui, Abu Bakar Salleh, Yahaya M. Normi, Nor Azah Yusof

Affiliation: Department of Chemistry, Faculty of Science, Universiti Putra Malaysia

Email: ainliah@upm.edu.my

ACKNOWLEDGEMENT

This research was funded under GP-IPB [Project Number = GP-IPB/2017/9580900